

What is claimed is:

1. A biomass gasifier apparatus, comprising:

- (A) a fuel input system;
- (B) a gasifier cell, receiving fuel from the fuel input system; and
- (C) whereby heated gas is supplied to the gasifier cell, and a mixture of gases, char and ash is exhausted from an upper portion of the gasifier cell.

2. The biomass gasifier apparatus of claim 1, wherein the gasifier cells comprises a fluidized bed gasifier cell, comprising:

- (a) bed material, carried at the base of the fluidized bed gasified cell;
- (b) a fluidizing gas plenum, carried within the fluidized bed gasifier cell;
- (c) a plurality of manifolds, arranged within the fluidized bed gasifier cell, whereby a space is sufficient between adjacent manifolds to allow tramp material to pass downwardly; and
- (d) a plurality of nozzles are supported by each manifold, whereby gas released by the nozzles fluidizes the bed material.

3. The biomass gasifier apparatus of claim 2, additionally comprising:

- (A) a cyclone, having an input in communication with the fluidized bed gasifier cell, for receiving a mixture of gases, char and ash from an upper portion of the fluidized bed gasifier cell, and for separating the mixture into first and second outputs, comprising a first output exhausting a mixture of low BTU gas, and a second output exhausting gas carrying a mixture of ash and char.

4. The biomass gasifier apparatus of claim 2, additionally comprising:

- (A) a bed change-out system, in communication with the fluidized bed gasifier cell, for removing tramp, clinkers and other waste from the bed material.

- 1 5. The biomass gasifier apparatus of claim 1, additionally comprising:
- 2 (a) a primary gas clean-up system, having an input attached to the gasifier cell,
- 3 whereby output from the fluidized bed gasifier cell is enhanced by the removal of
- 4 char and ash from the gas.
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- 6 6. The biomass gasifier apparatus of claim 5, additionally comprising:
- 7 (A) a char combustion cell, having an input connected to the second output of the
- 8 high-temperature gas clean-up system, oxidizes the char at elevated
- 9 temperatures.
- 10
- 11 7. The biomass gasifier apparatus of claim 6, additionally comprising:
- 12 (A) a heat exchanger, having a first input connected to an output of the char
- 13 combustion cell, receives gas leaving the char combustion cell and removes heat
- 14 energy.
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- 16 8. The biomass gasifier apparatus of claim 7, additionally comprising:
- 17 (A) a secondary gas cleanup unit, having an input connected to a first output of the
- 18 heat exchanger, receives gases discharged from the char combustion cell that
- 19 have been cooled by the heat exchanger, and removes ash from the gas and
- 20 exhausts cleaned gas through an output.
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- 22 9. The biomass gasifier apparatus of claim 8, wherein the secondary gas cleanup unit
- 23 comprises a cyclone.
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- 25 10. The biomass gasifier apparatus of claim 9, wherein the secondary gas cleanup unit
- 26 comprises a multi-clone.
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- 1 11. The biomass gasifier apparatus of claim 9, wherein the secondary gas cleanup unit
2 comprises a electrostatic precipitator.
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- 4 12. The biomass gasifier apparatus of claim 4, wherein the secondary gas clean-up system
5 comprisès:
6 (A) a cyclone, having an input in communication with the gasifier cell, for receiving a
7 mixture of gases, char and ash from an upper portion of the gasifier cell, and for
8 separating the mixture into first and second outputs, comprising a first output
9 exhausting a mixture of low BTU gas, and a second output exhausting gas
10 carrying a mixture of ash and char.
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- 12 13. The biomass gasifier apparatus of claim 12, additionally comprising:
13 (A) a char combustion cell, having an input connected to the second output of the
14 cyclone, oxidizes the char at elevated temperatures.
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- 16 14. The biomass gasifier apparatus of claim 13, additionally comprising:
17 (A) a heat exchanger, having a first input connected to an output of the char
18 combustion cell, receives gas leaving the char combustion cell and removes heat
19 energy.
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1 15. The biomass gasifier apparatus of claim 14, additionally comprising:
2 (A) a secondary gas cleanup unit, having an input connected to a first output of the
3 heat exchanger, receives gases discharged from the char combustion cell that
4 have been cooled by the heat exchanger, and removes ash from the gas and
5 exhausts cleaned gas through an output.
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7 16. The biomass gasifier apparatus of claim 15, wherein the secondary gas clean-up system
8 comprises:
9 (A) a multi-clone unit.
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11 17. The biomass gasifier apparatus of claim 15, wherein the secondary gas clean-up system
12 comprises:
13 (A) a cyclone.
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15 18. The biomass gasifier apparatus of claim 15 wherein the secondary gas clean-up system
16 comprises:
17 (A) a ceramic filter.
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19 19. The biomass gasifier apparatus of claim 15, wherein the secondary gas clean-up system
20 comprises:
21 (A) a baffle device.
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1 20. The biomass gasifier apparatus of claim 14, additionally comprising:

- 2 (A) a fluid bed gasifier fan, having an input connected to the output of the gas
3 cleanup unit, forces a gas mixture of the cleaned gas from the gas cleanup unit
4 and additional gas at high pressure into a second input of the heat exchanger,
5 wherein the gas mixture is heated, exhausted from a second output of the heat
6 exchanger, and delivered to the fluidizing gas plenum of the fluid bed gasifier cell.

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10 21. A biomass gasifier apparatus, comprising:

- 11 (A) a fuel input system;
12 (B) a fluidized bed gasifier cell, receiving fuel from the fuel input system;
13 (C) whereby a mixture of gases, char and ash is exhausted from an upper portion of
14 the fluidized bed gasifier cell;
15 (D) a cyclone, having an input in communication with the fluidized bed gasifier cell,
16 for receiving a mixture of gases, char and ash from an upper portion of the
17 fluidized bed gasifier cell, and for separating the mixture into first and second
18 outputs, comprising a first output exhausting a mixture of low BTU gas, and a
19 second output exhausting gas carrying a mixture of ash and char; and
20 (E) a char combustion cell, having an input connected to the second output of the
21 cyclone, oxidizes the char at elevated temperatures; and
22 (F) whereby gas heated within the char combustion cell is use to fluidize the fluidized
23 bed gasifier cell.

- 1 22. A biomass gasifier apparatus, comprising:
- 2 (A) a fuel input system;
- 3 (B) a fluidized bed gasifier cell, receiving fuel from the fuel input system, comprising:
- 4 (a) bed material, carried at the base of the fluidized bed gasified cell;
- 5 (b) a fluidizing gas plenum, carried within the fluidized bed gasifier cell;
- 6 (c) a plurality of manifolds, arranged within the fluidized bed gasifier cell,
- 7 whereby a space is sufficient between adjacent manifolds to allow tramp
- 8 material to pass downwardly; and
- 9 (d) a plurality of nozzles are supported by each manifold, whereby gas
- 10 released by the nozzles fluidizes the bed material; and
- 11 (C) a bed change-out system, in communication with the fluidized bed gasifier cell,
- 12 for removing tramp, clinkers and other waste from the bed material;
- 13 (D) a cyclone, having an input in communication with the fluidized bed gasifier cell,
- 14 for receiving a mixture of gases, char and ash from an upper portion of the
- 15 fluidized bed gasifier cell, and for separating the mixture into first and second
- 16 outputs, comprising a first output exhausting a mixture of low BTU gas, and a
- 17 second output exhausting gas carrying a mixture of ash and char;
- 18 (E) a char combustion cell, having an input connected to the second output of the
- 19 cyclone, oxidizes the char at elevated temperatures;
- 20 (F) a heat exchanger, having a first input connected to an output of the char
- 21 combustion cell, receives gas leaving the char combustion cell and removes heat
- 22 energy;
- 23 (G) a gas cleanup unit, having an input connected to a first output of the heat
- 24 exchanger, receives gases discharged from the char combustion cell that have
- 25 been cooled by the heat exchanger, and removes ash from the gas and exhausts
- 26 cleaned gas through an output; and
- 27 (H) a fluid bed gasifier fan, having an input connected to the output of the gas
- 28 cleanup unit, forces a gas mixture of the cleaned gas from the gas cleanup unit

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and additional gas at high pressure into a second input of the heat exchanger, wherein the gas mixture is heated, exhausted from a second output of the heat exchanger, and delivered to the fluidizing gas plenum of the fluid bed gasifier cell.